

- 17 -

WHAT IS CLAIMED IS:

1. A method for defining a three-dimensional structure comprising a plurality of material layers between upper and lower substrates through computer simulation using input data of mask layout, wherein the three-dimensional structure is defined during the computer simulation by depositing material layers on the upper and lower substrates acting as reference base planes, respectively, and sandwiching an intermediate insertion layer between the upper and lower substrates with the material layers thereon facing each other, in particular, when at least one of the material layers has a tapered region (which will be referred to as an "tapered material layer"), which is not parallel to the upper and lower substrates and is inclined to the base planes.

2. The method as set forth in Claim 1, comprising the steps of:

a) designating a certain material layer as the intermediate insertion layer among the plurality of material layers formed between the upper and lower substrates, followed by designating parameters including a thickness of the intermediate insertion layer and/or a kind

- 18 -

of material thereof;

5       b) designating information of a name, a kind  
of material, a thickness, and an associated mask  
for each of the plurality of material layers  
deposited onto the upper substrate and the lower  
substrate formed at upper and lower surfaces of  
the three-dimensional structure with the  
intermediate insertion layer formed at the  
center between the upper and lower substrates,  
10       and information of a taper angle of the tapered  
material layer when the at least one of the  
material layers has the tapered region, which is  
not parallel to the upper and lower substrates  
and is inclined to the base planes, followed by  
15       defining a deposition sequence for the material  
layers on the upper and lower substrates,  
respectively; and

20       c) determining whether each of the material  
layers is formed by use of polygons defining a  
mask layout object defined for the associated  
mask as a lower surface of the material layer or  
by use of remaining regions as the lower surface  
of the material layer except for the polygons  
defining the mask layout object defined for the  
25       associated mask.

3     The method as set forth in Claim 1,

- 19 -

comprising the steps of:

5 a) forming an internal polygon within a polygon defining a mask layout object for a mask having a designated taper angle, the internal polygon having a size smaller than the polygon defining the mask layout object while having the same shape and sequence of apexes as those of the polygon defining the mask layout object, followed by forming side polygons dividing a  
10 planar space between the internal polygon and the polygon defining the mask layout object by connecting the apexes of the internal polygon to the associated apexes of the polygon defining the mask layout object such that the apexes  
15 having the same sequences are connected to each other from the internal polygon to the polygon defining the mask layout object;

20 b) forming lines at both sides of edges of each of polygons defining a mask layout object defined for another mask except for the mask having the designated taper angle so as to be parallel to both sides of the edges of each of the polygons at an overlap region between the polygons defining the mask layout object defined  
25 for the other mask except for the mask having the designated taper angle and the polygon defined for the mask having the designated taper

- 20 -

angle, followed by dividing the polygon defined for the mask having the designated taper angle by use of the lines;

5 c) when forming the material layer using a mask without the designated taper angle or the material layer formed without a designated mask according to information of a deposition sequence for the material layers on the lower substrate, depositing a material for the  
10 material layer using the mask without the designated taper angle to have a thickness designated by a user upward from an upper surface of the material layer previously defined on the lower substrate

15 d) when forming the material layer using the mask having the designated taper angle according to the information of the deposition sequence of the material layers on the lower substrate, defining the mask layout object as a lower  
20 surface of the material layer using the mask having the designated taper angle over the upper surface of the material layer previously defined on the lower substrate, the internal polygon of the mask layout object as an upper surface of  
25 the material layer using the mask having the designated taper angle at a position spaced a predetermined thickness upward from the upper

- 21 -

surface of the material layer previously defined on the lower substrate, and the side polygons of the mask layout object as side surfaces of the material layer using the mask having the  
5 designated taper angle, respectively, followed by depositing a new material for the material layer formed using the mask having the designated taper angle in a region surrounded by the polygon of the lower surface, the polygon of  
10 the upper surface, and the polygons of the side surfaces;

e) when forming the material layer using the mask without the designated taper angle or the material layer formed without using the  
15 designated mask according to the information of the deposition sequence of the material layers on the upper substrate, depositing another new material for the material layer formed using the mask without the designated taper angle or the  
20 material layer formed without using the designated mask to have a predetermined thickness downward from a lower surface of the material layer previously defined on the upper substrate;

25 f) when forming the material layer using the mask having the designated taper angle according to information of a deposition sequence of the

- 22 -

material layers on the upper substrate, defining  
the mask layout object as an upper surface of  
the material layer using the mask having the  
designated taper angle over the lower surface of  
the material layer previously defined on the  
upper substrate, the internal polygon of the  
mask layout object as a lower surface of the  
material layer using the mask having the  
designated taper angle at a position spaced a  
predetermined thickness downward from the lower  
surface of the material layer previously defined  
on the upper substrate, and the side polygons of  
the mask layout object as side surfaces of the  
material layer using the mask having the  
designated taper angle, respectively, followed  
by depositing another new material for the  
material layer formed using the mask having the  
designated taper angle in a region surrounded by  
the polygon of the upper surface, the polygon of  
the lower surface, and the side surfaces;

g) when forming the material layer using the  
mask having the designated taper angle according  
to the information of the deposition sequence of  
the material layers on the upper substrate,  
depositing another new material for the material  
layer downwardly, the material layer using the  
mask layout object as an upper surface of the

- 23 -

material layer using the mask having the  
designated taper angle on the lower surface of  
the material layer previously defined on the  
upper substrate, the internal polygon of the  
mask layout object as a lower surface of the  
material layer using the mask having the  
designated taper angle at a position spaced the  
predetermined thickness downward from the lower  
surface of the material layer previously defined  
on the upper substrate, and the side polygons of  
the mask layout object as side surfaces of the  
material layer using the mask having the  
designated taper angle;

h) displacing the upper substrate upward  
such that the highest apex among the apexes of  
the polygons constituting the upper surface of  
the defined lower substrate is located at a  
position spaced a thickness of the crystal  
liquid region designated by the user from the  
lowest apex among the apexes of the polygons  
constituting the upper surface of the defined  
lower substrate; and

i) filling a space between the upper  
substrate and the lower substrate with the  
intermediate insertion layer.